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James R. Wells

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DISCHARGE CHARACTERISTICS OF RECTANGULAR NOTCH WEIRS IN RECTANGULAR CHANNELS

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DISCHARGE CHARACTERISTICS OF RECTANGULAR NOTCH

WEIRS IN RECTANGULAR CHANNELS

Approved:

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ABSTRACT

The purpose of this investigation was to determine the discharge characteristics of the rectangular notch weir for a full range of geometric variables and a limited range of fluid-property variables.

The weir form involved in this study is a symmetrical, sharp-edged, rectangular notch in a smooth, vertical, thin plate located in a smooth, long, horizontal, rectangular channel. It is assumed that the discharge is fully ventilated and unsubmerged. The boundary variables are: width of the notch (b); width of the channel (B); and height of the notch crest above the channel bottom (P). The flow variables are the mean velocity over the crest (V), and the static head on the crest (h). The fluid (liquid) property variables involved are density (ρ); viscosity (μ); and surface tension (σ).

From dimensional analysis, the discharge coefficient, C, is a function of five dimensionless ratios, including three geometric ratios, the Reynolds number, and the Weber number. One of the geometric ratios, a shape factor, was shown by experiment to be insignificant. The Reynolds and Weber numbers, representing the relative influence of viscosity and surface tension, respectively, are of minor significance except at very low values of the head and notch width. Thus, the principal variables are the dimensionless ratios C, P/h, and b/B.

The so-called standard rectangular notch weir has long been used as a flow meter. The several well-known empirical discharge formulae, however, are all restricted in application to a narrow range of values of

the geometric variables. It was the particular object of this investigation to define the discharge function over the full range of the geometric parameters.

Because it involves more than one fluid property and relatively complex boundary conditions, the flow pattern for weir discharge is not subject to complete analytical description. This investigation, therefore involved a systematic series of tests carried on in a 3-by 3-foot flume in the Georgia Tech Hydraulics Laboratory. No attempt was made to fit empirical equations to the test results. It was found that except for very small heads and notch widths, all of the test data could be correlated on a three-dimensional plot of C against $bh/B(h + P)$ and b/B. Thus, in a single diagram the discharge function is defined over a much broader range of the pertinent variables than has hitherto been available.

As only one fluid--water at room temperatures--was used, the experimental investigation did not cover a full range of the fluid-property parameters. To do so would involve testing with different liquids and at different scales. The problem of defining the separate influences due to surface tension and viscosity is one which deserves future attention.

CHAPTER I

INTRODUCTION

<u>Definition of the Problem</u>.--The basic weir form involved in this investigation is a symmetrical, sharp-edged, rectangular notch in a smooth, vertical, thin plate located in a smooth, long, horizontal channel. It is assumed that the discharge is fully ventilated and unsubmerged. A definitive sketch of the weir is shown on figure 1.

The boundary variables involved in the discharge function for the basic rectangular notch weir are: the width of the notch, b; the width of the channel, B; and the height of the notch crest above the channel bottom, P. There is only one independent flow variable involved, and it can be expressed either as the static head, h, as the velocity over the crest, V, or as a significant pressure difference, Δp. If the velocity is selected as a dependent variable, however, either h or Δp may be considered as independent. The fluid-property variables involved in fluid (liquid) flow over a weir are density, ρ ; viscosity, μ ; and surface tension, σ . Thus, with g, the acceleration due to gravity, a sufficient number of variables to describe the discharge function is contained in the functional expression:

$$\phi(h \text{ or } \Delta p, V, P, B, \rho, \mu, \sigma, g) = 0 \qquad (1)$$

There are three independent dimensions and nine variables in equation 1. Therefore, a maximum of six dimensionless ratios can be formed.

One of these will be the coefficient of discharge, which is conveniently taken as the dependent ratio. It follows that C is a function of three geometric ratios and two fluid-property ratios,

$$C \approx \frac{Q}{bh\sqrt{gh}} \approx \phi\left(\frac{P}{h}, \frac{B}{h}, \frac{b}{h}, \underline{R}, \underline{W}\right) \tag{2}$$

where R and W are the Reynolds and Weber numbers, respectively.

The Discharge Equation.--In the traditional development, attributed to Weisbach, the weir equation describes a limiting case of flow from a two-dimensional slot under low head. From the Bernoulli equation, neglecting energy losses, the velocity at any point in the full-contracted jet is,

$$v = \sqrt{2g(h_o + \frac{V_o^2}{2g} - z)}, \tag{3}$$

where h_o is the piezometric level (or the elevation of the free surface in an assumed uniform-flow approach section, $(V_o^2/2g)$ is the average velocity head in the approach section, and z is the elevation of the point at which the velocity is v.

Derivation of the discharge equation involves integration of the velocity equation over the width and elevation limits of the stream in the plane of the opening. For a suppressed (two-dimensional) weir this is accomplished by assuming for elevation limits the top-edge of the weir crest and the piezometric level in the approach section. Thus, if the datum is taken to be the crest level, the lower limit is zero and the upper limit is h, the elevation of the free surface in the approach channel. This assumption implies that the area of discharge is proportional to the head, h. The actual area at this section, however, must be defined in terms of an area-contraction coefficient, C_c. For corresponding boundary conditions this coefficient and the coefficient of contraction for plate orifices are similar in magnitude as well as function. Values of C_c for weirs, however, are derived from experiment. They cannot, as is the case for certain types of orifices, be derived from hydrodynamics.

The procedure described above leads to:

$$Q = C_c\, b \left(\frac{2}{3} \sqrt{2g}\right) \left[\left(h + \frac{V_o^2}{2g}\right)^{3/2} - \left(\frac{V_o^2}{2g}\right)^{3/2}\right] , \qquad (4)$$

where Q is the volume rate of flow and C_c is a function of boundary geometry alone. Application of this equation involves a successive approximation solution for the velocity of approach. The complicating term, $V_o^2/2g$, in the bracket is not an independent variable, however. It is actually a function of the flow and geometric variables incorporated or implied in the remaining terms. It is convenient, therefore, to simplify the discharge equation to a form adapted to a semi-graphical solution,

$$Q = C\, b \left(\frac{2}{3}\sqrt{2g}\right) h^{3/2}, \qquad (5)$$

where C is the coefficient of discharge. From equations 4 and 5,

$$C = C_c \left[\left(\frac{V_o^2}{2gh} + 1\right)^{3/2} - \left(\frac{V_o^2}{2gh}\right)^{3/2}\right] \qquad (6)$$

In equation 6, the term $V_o^2/2gh$ is proportional to the geometric ratio $C_c h/(P + h)$, from which it follows that C, as well as C_c, is a function of geometry alone.

From equation 2, based on dimensional analysis, the coefficient of discharge was shown to be a function of two fluid-property parameters as well as three geometric ratios. These fluid parameters, namely the Reynolds and Webers numbers, are ignored in the foregoing energy analysis because it is acknowledged that the influence of viscosity and surface tension cannot be evaluated in this manner. Thus, as for most similar flow patterns involving the influence of more than one fluid property and complex boundary conditions, the coefficient of discharge must be determined from experiment.

Review of the Literature.--Probably no other single problem has received more attention in the technical literature of hydraulics than the measuring weir. References to the weir start with Poleni in 1717, but most of the laboratory research on the problem was accomplished in the early part of the last century. James B. Francis in this country, Bazin in France, and Rehbock in Germany, are outstanding names generally associated with the weir and weir discharge formulae. Francis (1) in 1854, published a classic account of his experiments on weirs made in the Lower Lock at Lowell, Massachusetts. Bazin's work (2) was first published in 1888. One of Rehbock's first publications of importance was in 1912. Many others, including Fteley and Stearns (3), Nagler (4), Frese (5) and Schoder and Turner (6) made important contributions to our knowledge of the weir.

Most of the early workers in this field confined their attention to the suppressed rectangular weir. This, as contrasted with the notch weir, involves a level crest which occupies the full width of the channel.

Despite the simplifications associated with the suppressed weir, however, agreement between the many capable workers in the field has not been notable.

Among the most widely used empirical formulae for the discharge coefficient for the suppressed weir, the Rehbock formula (7) probably has the greatest following in this country. As most commonly used, this formula is,

$$C = 0.605 + 0.008 \frac{h}{P} + \frac{1}{305\ h} \tag{7}$$

For application to laboratory-size weirs, Rehbock claimed a very high degree of accuracy for his formula as long as the nappe sprung free of the crest and the under side of the nappe was fully ventilated. Several authorities disagree with the originator, however, claiming that it is applicable only to small weirs and small heads. Another formula for suppressed weirs, which is widely used in Europe, is that proposed by the Swiss Society of Engineers and Architects (S.I.A.) (8) in 1924. As this formula appears in the S.I.A. Code for Water Measurements, it is,

$$C = 0.615 \left(1 + \frac{1}{305\ h + 1.6}\right)\left[1 + 0.5 \left(\frac{h}{P+h}\right)^{2}\right] . \tag{8}$$

It is specified in the Code that equation 8 is applicable only when P is equal to or greater than 11 inches, h is between 1 inch and 31.4 inches, and h/P is equal to or less than unity.

When most suppressed weir formulae are applied to notch weirs, they are customarily restricted to values of b greater than 3h and values of B not less than (b + 6h). Within these limits the effect of width contraction is generally evaluated from the empirical relationship proposed by Francis,

$$b_{net} = b_{gross} - 0.2\ h \tag{9}$$

One of the very few formulae developed especially for the rectangular notch weir was also proposed by the S.I.A. in their Code for Water Measurements. This formula,

$$C = \left[0.578 + 0.037\left(\frac{b}{B}\right)^2 + \frac{3.615 - 3\left(\frac{b}{B}\right)^2}{305\ h + 1.6}\right] \left[1 + 0.5\left(\frac{b}{B}\right)^4 \left(\frac{h}{P + h}\right)^2\right], \tag{10}$$

is recommended only when P is equal to or greater than 11 inches; h is between $1.0\left(\frac{B}{b}\right)$ and 31.4 inches, h/P is equal to or less than unity; and b/B is equal to or greater than 0.3.

It is apparent that neither the suppressed weir formulae, modified by means of the Francis width-contraction term, nor any of the known notch-weir formulae will satisfy the main requirement of this investigation--that is, that the discharge function be defined over a full range of the pertinent variables. In fact, regardless of the great quantity of data and the many weir formulae published, a satisfactory solution for the problem described herein is not available.

CHAPTER II

INSTRUMENTATION AND EQUIPMENT

General.—All laboratory tests were made in the Hydraulics Laboratory of the Georgia Institute of Technology, School of Civil Engineering. Most of the equipment required for the tests, as described below, is a permanent part of the laboratory.

Flume.—The weir was located in an existing flume three feet wide and three feet deep. The approach channel upstream from the weir was about twenty feet long. The floor of the flume was horizontal. Figure 2 shows a general view of the flume and the general arrangement of the equipment.

Baffles.—A series of wood, metal, and wire screen baffles was placed upstream from the weir to insure a uniform velocity distribution in the approach section. The efficacy of the baffles over a full range of discharges was checked by means of velocity measurements made with a Pygmy current meter. Results of four complete velocity traverses are shown in Table 1.

False Bottom.—In order to create the required range of values of the weir height, P, a smooth false bottom made of aluminum and plywood was installed upstream from the weir. The false bottom was ten feet long. It was supported by means of threaded rods which permitted it to be adjusted to various heights. Figure 3 shows the false bottom in position in the flume.

Weir Plate.--The basic weir plate used for all tests was made of 3/8-inch aluminum plate. The notch edges were made of stainless steel, machined accurately to sharp-cornered edges not over 1/16-inch thick. The width of the notch was varied by means of additional aluminum plates which were bolted to the basic weir. The notch for all tests was one foot deep. Widths were varied from 0.15 feet to 2.70 feet. Figure 4 shows a view of a typical weir arrangement.

Head-Measuring Apparatus.--The head on the weir was measured by means of a hook-gage manometer connected to piezometers located in the false floor five feet upstream from the weir plate. The hook-gage and its stilling well was located on the side of the flume adjacent to the weir plate. The hook-gage zero reading was determined by means of an engineer's transit. It was checked regularly. It is estimated that the head was measured with a possible accuracy of ± 0.0005 feet.

Water Supply.--The water supply for the tests was obtained from the laboratory's constant-head recirculation system. A gate valve was used to control the flow into the flume. The maximum discharge used in the tests was 5.8 cubic feet second. Water temperatures were recorded during the tests.

Discharge Measurements.--The rate of flow was measured by means of a weighing tank located below the downstream end of the flume. Measurements recorded involved weight, time and temperature. Weights were recorded to the nearest one pound on a platform beam scale. Time measurements were made to the nearest 0.01 second by means of an electric stop clock. Figure 5 shows the weighing tank arrangement.

CHAPTER III

PROCEDURE

Analysis of the Problem.--In Chapter 1, equation 2, it was established that the discharge coefficient for the notch weir could be described by the functional expression,

$$C = \phi\left(\frac{P}{h}, \frac{B}{h}, \frac{b}{h}, \frac{R}{}, \frac{W}{}\right) \quad . \tag{11}$$

In this equation the first three ratios are geometric parameters. The last two ratios are the Reynolds and Weber numbers, which are descriptive of the viscosity and surface tension influences, respectively.

The ratio P/h is a shape ratio. In many weir formulae it appears as an important variable. In some of these, it appears in the equivalent form h/(P + h), which is proportional to a Froude number for the approach channel.

The ratios B/h and b/h are also shape ratios. One of their cross-product forms, b/B, is the width-contraction ratio, commonly used to describe the geometry of the simple two-dimensional orifice. In the latter form it also appears in the S.I.A. formula for notch weirs, equation 11.

The Reynolds number is defined as the ratio of a typical inertial reaction to a typical viscous shear force. Thus, it is a number which varies inversely with the relative influence of viscosity on a given flow pattern. The general expression for the Reynolds number is,

$$\underline{R} = \frac{VL\rho}{\mu}, \tag{12}$$

where V is a typical velocity, L is a significant length, ρ is the density, and μ is the viscosity of the fluid. For the weir, discharge velocities are proportional to the square-root of the head; thus, $\sqrt{h}$ can be substituted for V in the definition of $\underline{R}$. For suppressed weirs, the only convenient and significant length is the head. Under certain circumstances for notch weirs, however, the width may be smaller and possibly more significant than the head. Thus, either h or b could be used in place of L in equation 12. For a given liquid in a narrow range of temperatures, furthermore, both ρ and μ are essentially constant. It follows that for wide weirs, $\underline{R} \sim Vh \sim h^{3/2}$; whereas, for narrow weirs a more significant definition might be, $\underline{R} \sim Vb \sim h^{1/2}b$. The distinction between "wide" and "narrow" weirs must be based on experiment.

The Weber number is a ratio similar to the Reynolds number except that it is a measure of the relative influence of surface tension. The Weber number is usually written,

$$\underline{W} = \frac{V}{\sqrt{\frac{\sigma}{\rho L}}} \tag{13}$$

Because σ is essentially constant for a given liquid at room temperatures, the Weber number, like the Reynolds number, is a function of either h or b, depending on which is the most significant. For wide weirs, therefore, $\underline{W} \sim V^2h \sim h^2$; and, for narrow weirs, $\underline{W} \sim V^2b \sim hb$.

From the structure of the Reynolds number it is apparent that the influence of viscosity is appreciable only when the magnitude of R is relatively small. Thus, if the investigation is limited to a single liquid of small viscosity the influence of R on the coefficient of discharge is appreciable only when h or b, or both, are small. Similarly, the influence of surface tension is appreciable only when h or b, or both, are relatively small. Unfortunately, however, when either viscosity or surface tension influence the flow of a given liquid over a weir it is impossible to determine the comparative magnitude of the two effects unless similar boundary conditions are tested at different scales.

It is apparent that an investigation of the fluid-property characteristics of the discharge coefficient is beyond the scope of a single investigation of this kind. In order to determine the limiting conditions of the R or W influence, however, tests must be made at small values of both h and b. Many investigators have attempted to evaluate the effect of low heads on suppressed weirs. In fact, the last term in the Rehbock formula is the result of one such effort. The separate influence of viscosity and surface tension, however, has not been determined. As far as the writer knows, no one has attempted to evaluate the effect of small values of notch width as an alternative measure of the length term in R and W.

Scope of the Experimental Program.--It was the purpose of the experimental program to investigate a full range of the geometric variables involved in the flow of one liquid--water at room temperatures--over notch weirs. This implies a variety of weir heights ranging from the free overfall to the condition of negligible approach velocities. It implies a variety of notch widths from the vertical slot to the suppressed weir. It also implies a range of heads (and discharges) limited only by the laboratory facilities. Actually, all of these conditions were satisfied by the tests reported herein, except that a series of tests on the suppressed weir was not made. To have made these tests would have required extensive alterations of the flume in order to provide ample ventilation for the under side of the nappe. It was considered unnecessary to do this because of the wealth of experimental data available on the suppressed weir.

The tests made for this investigation cover five values of P, from zero to 1.84 feet; six values of b, from 0.12 to 2.70 feet; and heads ranging from 0.07 to 0.9 feet. All tests were made in a 3-by 3-foot flume; therefore, B was constant and equal to 3 feet. The range in temperatures observed during the tests was from 74.0 to 83.0 degrees Fahrenheit. The maximum discharge measured was 5.8 cubic feet per second. A total of 280 tests were made. The results are shown in Table 2.

Analysis of the Data.--Disregarding the fluid-property parameters, the coefficient of discharge defined by equation 2 is a function of three geometric ratios. It was anticipated that a combination or transformation of two or more of these ratios could be found which would reduce the total number of effective parameters involved, including C, to not more than three. With only three variables involved, a semi-graphical solution of the discharge function can be presented on a single graph.

After many analytical procedures were investigated, it was determined that an alternative form of the functional relationship for C, omitting R and W, would be best adapted to the correlation of the majority of the test data. This relationship,

$$C = \phi\left(\frac{b}{B}, \frac{bh}{B(h+P)}, \frac{P}{b}\right) \tag{14}$$

was particularly satisfactory because it was demonstrated by the tests that the influence of P/b was negligible. Thus, the coefficient of discharge for all tests except those which involved small values of h or b were correlated as a function of the width ratio, b/B, and an area ratio, bh/B(h + P).

CHAPTER IV

DISCUSSION OF RESULTS

Summary.--Figures 6 to 11, inclusive, show the data in Table 2 plotted on semi-logarithmic graphs. Each figure shows the results of tests made for a constant value of b/B. Figure 12 shows a similar plot of data for a suppressed weir ($b/B = 1.0$) taken from tests performed by the U. S. Bureau of Reclamation (9). On each graph, the influence of small values of h is indicated by an increase in the value of C at the lower values of $bh/B(h + P)$. On all of the plots, an average curve has been drawn through the data except in the range where the influence of h is apparent. Thus, the lower left arm of each curve has been drawn parallel to the horizontal axis of the graph. It is suggested that the value of C represented by this horizontal projection is the value of C which would be applicable to large weirs, i.e., large heads and negligible viscosity and surface tension influences.

Figure 13 is a composite of the curves shown in figures 6 to 12, inclusive. The curve shown on figure 6, for $b/B = 0.04$, is included in figure 13, although it is believed that the data on figure 6 reflects the independent influence of small values of notch width. This conclusion is based on the observation that the data on this figure are inconsistent with the trends indicated by the other graphs.

Discussion.--Indications of the influence of both h and b have been ignored in the preparation of figures 6 to 12, inclusive. Thus, it is acknowledged that the effects of viscosity and surface tension (i.e., R and W) are not clearly indicated by these tests. With this exception, however, the coefficient of discharge is satisfactorily correlated as a function of $bh/B(h+P)$ for each value of b/B.

When curves drawn by estimate through the test data are shown in a composite diagram, as in figure 13, they fail to yield a perfectly clear picture of the systematic influence of the b/B ratio. No attempt has been made to adjust the curves, however, for it is believed that additional refinement will have to be based on tests made at a larger scale. Actually, the maximum spread between all the curves shown on figure 13 is only about 8 per cent of the mean value of C. It is reasonable to believe that the individual curves are defined to the nearest one per cent. That this is an acceptable degree of accuracy for measurements of this kind is indicated by the comparison shown on figure 12 for the suppressed weir.

CHAPTER V

CONCLUSIONS

1. The coefficient of discharge for rectangular notch weirs is a function of three geometric parameters and two fluid-property parameters.

2. For larger heads and notch widths, the influence of the fluid-property parameters is negligible.

3. Experiments show that one of the geometric parameters can be ignored.

4. Over a practical range, the coefficient of discharge for rectangular notch weirs can be expressed as a function of an area ratio, $bh/B(h+P)$, and a width ratio, b/B.

5. An empirical solution has been accomplished for the discharge characteristics of rectangular notch weirs discharging water at room temperature.

APPENDIX

Table 1. Velocity Distribution*

Run No.	P	b	x	y	V
	feet	feet	feet	feet	f.p.s.
A	1.842	2.706	0.1	0.1	0.356
	1.842	2.706	0.1	0.2	0.380
	1.842	2.706	0.1	0.6	0.466
	1.842	2.706	0.1	1.0	0.466
	1.842	2.706	0.1	1.2	0.447
	1.842	2.706	0.1	1.6	0.429
	1.842	2.706	0.1	2.0	0.438
	1.842	2.706	0.1	2.3	0.456
	1.842	2.706	1.0	0.1	0.421
	1.842	2.706	1.0	0.2	0.438
	1.842	2.706	1.0	0.6	0.456
	1.842	2.706	1.0	1.0	0.447
	1.842	2.706	1.0	1.2	0.447
	1.842	2.706	1.0	1.6	0.391
	1.842	2.706	1.0	2.0	0.335
	1.842	2.706	1.0	2.3	0.380
	1.842	2.706	1.5	0.1	0.371
	1.842	2.706	1.5	0.2	0.405
	1.842	2.706	1.5	0.6	0.421
	1.842	2.706	1.5	1.0	0.421
	1.842	2.706	1.5	1.2	0.380
	1.842	2.706	1.5	1.6	0.316
	1.842	2.706	1.5	2.0	0.310
	1.842	2.706	1.5	2.3	0.328
	1.842	2.706	2.0	0.1	0.328
	1.842	2.706	2.0	0.2	0.363
	1.842	2.706	2.0	0.6	0.335
	1.842	2.706	2.0	1.0	0.348
	1.842	2.706	2.0	1.2	0.335
	1.842	2.706	2.0	1.6	0.371
	1.842	2.706	2.0	2.0	0.363
	1.842	2.706	2.0	2.3	0.335
	1.842	2.706	2.9	0.1	0.380
	1.842	2.706	2.9	0.2	0.438
	1.842	2.706	2.9	0.6	0.498
	1.842	2.706	2.9	1.0	0.498
	1.842	2.706	2.9	1.2	0.466
	1.842	2.706	2.9	1.6	0.380
	1.842	2.706	2.9	2.0	0.262
	1.842	2.706	2.9	2.3	0.290

(continued)

Table 1. Velocity Distribution* (continued)

Run No.	P	b	x	y	V
	feet	feet	feet	feet	f.p.s.
B	1.047	2.706	0.1	0.1	0.686
	1.047	2.706	0.1	0.2	0.658
	1.047	2.706	0.1	0.5	0.752
	1.047	2.706	0.1	0.8	0.887
	1.047	2.706	0.1	1.2	0.971
	1.047	2.706	0.1	1.6	0.887
	1.047	2.706	1.0	0.1	0.752
	1.047	2.706	1.0	0.2	0.735
	1.047	2.706	1.0	0.5	0.801
	1.047	2.706	1.0	0.8	0.868
	1.047	2.706	1.0	1.2	0.995
	1.047	2.706	1.0	1.6	1.01
	1.047	2.706	1.5	0.1	0.702
	1.047	2.706	1.5	0.2	0.672
	1.047	2.706	1.5	0.5	0.672
	1.047	2.706	1.5	0.8	0.771
	1.047	2.706	1.5	1.2	0.851
	1.047	2.706	1.5	1.6	0.887
	1.047	2.706	2.0	0.1	0.752
	1.047	2.706	2.0	0.2	0.752
	1.047	2.706	2.0	0.5	0.786
	1.047	2.706	2.0	0.8	0.949
	1.047	2.706	2.0	1.2	0.958
	1.047	2.706	2.0	1.6	1.44
	1.047	2.706	2.9	0.1	0.510
	1.047	2.706	2.9	0.2	0.672
	1.047	2.706	2.9	0.5	0.686
	1.047	2.706	2.9	0.8	0.686
	1.047	2.706	2.9	1.2	0.868
	1.047	2.706	2.9	1.6	1.24
C	0.427	2.706	0.1	0.1	1.55
	0.427	2.706	0.1	0.2	1.55
	0.427	2.706	0.1	0.4	1.58
	0.427	2.706	0.1	0.6	1.92
	0.427	2.706	0.1	0.8	1.83
	0.427	2.706	0.1	0.9	1.64
	0.427	2.706	1.0	0.1	1.71
	0.427	2.706	1.0	0.2	1.61
	0.427	2.706	1.0	0.4	1.56
	0.427	2.706	1.0	0.6	1.58
	0.427	2.706	1.0	0.8	1.55
	0.427	2.706	1.0	0.9	1.35

(continued)

Table 1. Velocity Distribution* (continued)

Run No.	P feet	b feet	x feet	y feet	V f.p.s.
	0.427	2.706	1.5	0.1	1.44
	0.427	2.706	1.5	0.2	1.48
	0.427	2.706	1.5	0.4	1.41
	0.427	2.706	1.5	0.6	1.38
	0.427	2.706	1.5	0.8	1.41
	0.427	2.706	1.5	0.9	1.32
	0.427	2.706	2.0	0.1	1.24
	0.427	2.706	2.0	0.2	1.35
	0.427	2.706	2.0	0.4	1.35
	0.427	2.706	2.0	0.6	1.38
	0.427	2.706	2.0	0.8	1.41
	0.427	2.706	2.0	0.9	1.34
	0.427	2.706	2.9	0.1	1.13
	0.427	2.706	2.9	0.2	1.24
	0.427	2.706	2.9	0.4	1.13
	0.427	2.706	2.9	0.6	1.06
	0.427	2.706	2.9	0.8	1.29
	0.427	2.706	2.9	0.9	1.38
D	0.148	2.706	0.1	0.1	2.62
	0.148	2.706	0.1	0.2	2.62
	0.148	2.706	0.1	0.4	2.39
	0.148	2.706	0.1	0.6	2.33
	0.148	2.706	1.0	0.1	2.58
	0.148	2.706	1.0	0.2	2.45
	0.148	2.706	1.0	0.4	2.58
	0.148	2.706	1.0	0.6	2.58
	0.148	2.706	1.5	0.1	2.28
	0.148	2.706	1.5	0.2	2.33
	0.148	2.706	1.5	0.4	2.28
	0.148	2.706	1.5	0.6	2.33
	0.148	2.706	2.0	0.1	2.67
	0.148	2.706	2.0	0.2	2.59
	0.148	2.706	0.20	0.4	2.33
	0.148	2.706	2.0	0.6	2.23
	0.148	2.706	2.9	0.1	2.28
	0.148	2.706	2.9	0.2	2.33
	0.148	2.706	2.9	0.4	2.00
	0.148	2.706	2.9	0.6	2.05

*All velocities were measured at a section five feet upstream from the weir. The distance x is measured from the left wall of the flume looking downstream; y is measured from the bottom of the flume.

Table 2. Discharge Measurements and Computations

Run No.	h	b	P	Q	$\frac{b}{B}$	$\frac{bh}{B(h+P)}$	C	Temp.
	feet	feet	feet	c.f.s.				°F.
1	0.074	2.706	1.842	0.191	0.901	0.034	0.657	74.0
2	0.104	2.706	1.842	0.310	0.901	0.048	0.644	74.0
3	0.142	2.706	1.842	0.525	0.901	0.067	0.632	74.0
4	0.225	2.706	1.842	0.959	0.901	0.097	0.626	74.0
5	0.291	2.706	1.842	1.403	0.901	0.123	0.622	74.0
6	0.386	2.706	1.842	2.133	0.901	0.156	0.622	74.0
7	0.470	2.706	1.842	2.874	0.901	0.183	0.618	74.0
8	0.527	2.706	1.842	3.421	0.901	0.201	0.619	74.0
9	0.598	2.706	1.842	4.137	0.901	0.221	0.620	74.5
10	0.601	2.706	1.842	4.172	0.901	0.222	0.620	74.0
11	0.625	2.706	1.842	4.456	0.901	0.228	0.624	74.0
12	0.626	2.706	1.842	4.446	0.901	0.229	0.622	74.5
13	0.652	2.706	1.842	4.745	0.901	0.235	0.624	74.5
14	0.666	2.706	1.842	4.916	0.901	0.240	0.626	74.5
15	0.084	3.999	1.842	0.197	0.800	0.035	0.632	75.5
16	0.085	3.999	1.842	0.201	0.800	0.035	0.632	75.5
17	0.108	3.999	1.842	0.287	0.800	0.044	0.630	75.5
18	0.135	3.999	1.842	0.393	0.800	0.054	0.618	75.5
19	0.173	3.999	1.842	0.564	0.800	0.069	0.611	75.5
20	0.246	3.999	1.842	0.957	0.800	0.094	0.611	75.5
21	0.404	3.999	1.842	1.993	0.800	0.144	0.606	75.5
22	0.427	3.999	1.842	2.654	0.800	0.167	0.609	75.5
23	0.575	3.999	1.842	3.390	0.800	0.190	0.608	75.5
24	0.634	3.999	1.842	3.907	0.800	0.205	0.603	75.5
25	0.702	3.999	1.842	4.591	0.800	0.221	0.607	75.5
26	0.088	1.800	1.842	0.154	0.600	0.027	0.613	75.5
27	0.110	1.800	1.842	0.215	0.600	0.033	0.613	75.5
28	0.146	1.800	1.842	0.327	0.600	0.044	0.610	75.5
29	0.164	1.800	1.842	0.384	0.600	0.049	0.602	75.5
30	0.254	1.800	1.842	0.736	0.600	0.073	0.597	75.5
31	0.336	1.800	1.842	1.120	0.600	0.092	0.598	75.5
32	0.404	1.800	1.842	1.477	0.600	0.108	0.598	75.5
33	0.440	1.800	1.842	1.678	0.600	0.116	0.597	76.0
34	0.507	1.800	1.842	2.082	0.600	0.130	0.599	76.0
35	0.585	1.800	1.842	2.570	0.600	0.145	0.597	76.0
36	0.660	1.800	1.842	3.074	0.600	0.158	0.596	76.0
37	0.712	1.800	1.842	3.439	0.600	0.167	0.595	76.0
38	0.787	1.800	1.842	3.965	0.600	0.179	0.590	76.0

(continued)

Table 2. Discharge Measurements and Computations (continued)

Run No.	h	b	P	Q	$\frac{b}{B}$	$\frac{bh}{B(h+P)}$	C	Temp.
	feet	feet	feet	c.f.s.				°F.
39	0.832	1.800	1.842	4.358	0.600	0.187	0.597	76.0
40	0.084	1.176	1.842	0.0978	0.392	0.017	0.640	76.0
41	0.143	1.176	1.842	0.213	0.392	0.028	0.626	76.0
42	0.208	1.176	1.842	0.366	0.392	0.040	0.613	76.0
43	0.329	1.176	1.842	0.707	0.392	0.060	0.597	76.0
44	0.364	1.176	1.842	0.820	0.392	0.065	0.595	76.0
45	0.403	1.176	1.842	0.957	0.392	0.071	0.595	76.0
46	0.465	1.176	1.842	1.182	0.392	0.079	0.593	76.0
47	0.533	1.176	1.842	1.447	0.392	0.088	0.591	76.0
48	0.618	1.176	1.842	1.817	0.392	0.098	0.595	76.0
49	0.720	1.176	1.842	2.273	0.392	0.110	0.592	76.0
50	0.875	1.176	1.842	3.042	0.392	0.126	0.591	76.0
51	0.074	0.592	1.842	0.039	0.197	.0076	0.612	77.0
52	0.122	0.592	1.842	0.081	0.197	.0122	0.602	77.0
53	0.158	0.592	1.842	0.118	0.197	.0156	0.595	77.0
54	0.249	0.592	1.842	0.228	0.197	.0234	0.580	77.0
55	0.354	0.592	1.842	0.381	0.197	.0317	0.573	77.0
56	0.507	0.592	1.842	0.652	0.197	.0426	0.571	77.0
57	0.533	0.592	1.842	0.708	0.197	.0441	0.575	77.0
58	0.716	0.592	1.842	1.106	0.197	.0552	0.577	77.0
59	0.874	0.592	1.842	1.511	0.197	.0634	0.584	77.0
60	0.206	0.119	1.842	0.036	0.040	.0040	0.600	78.0
61	0.341	0.119	1.842	0.076	0.040	.0062	0.605	78.0
62	0.381	0.119	1.842	0.091	0.040	.0068	0.607	78.0
63	0.437	0.119	1.842	0.112	0.040	.0077	0.615	78.0
64	0.476	0.119	1.842	0.128	0.040	.0082	0.616	78.0
65	0.491	0.119	1.842	0.133	0.040	.0084	0.611	78.0
66	0.084	2.704	1.047	0.220	0.901	.0669	0.625	80.0
67	0.118	2.704	1.047	0.364	0.901	.0910	0.621	80.0
68	0.180	2.704	1.047	0.681	0.901	.132	0.616	80.0
69	0.248	2.704	1.047	1.102	0.901	.172	0.619	80.0
70	0.314	2.704	1.047	1.569	0.901	.208	0.618	80.0
71	0.366	2.704	1.047	1.992	0.901	.233	0.622	80.0
72	0.416	2.704	1.047	2.431	0.901	.256	0.627	80.0
73	0.484	2.704	1.047	3.059	0.901	.285	0.628	80.0
74	0.534	2.704	1.047	3.543	0.901	.305	0.628	80.0
75	0.653	2.704	1.047	4.906	0.901	.346	0.643	80.0
76	0.062	2.399	1.047	0.128	0.200	.0447	0.646	79.5
77	0.116	2.399	1.047	0.318	0.200	.0798	0.627	79.5
78	0.182	2.399	1.047	0.609	0.200	.118	0.612	79.5
79	0.225	2.399	1.047	0.836	0.200	.142	0.611	79.5

(continued)

Table 2. Discharge Measurements and Computations (continued)

Run No.	h	b	P	Q	$\frac{b}{B}$	$\frac{bh}{B(h+P)}$	C	Temp.
	feet	feet	feet	c.f.s.				°F.
80	0.311	2.399	1.047	1.357	0.200	.183	0.610	79.5
81	0.400	2.399	1.047	1.990	0.200	.221	0.614	79.5
82	0.493	2.399	1.047	2.743	0.200	.256	0.618	79.5
83	0.591	2.399	1.047	3.588	0.200	.289	0.616	79.5
84	0.678	2.399	1.047	4.473	0.200	.314	0.625	79.5
85	0.732	2.399	1.047	5.167	0.200	.329	0.644	79.5
86	0.066	1.801	1.047	0.104	0.600	.0356	0.620	79.5
87	0.129	1.801	1.047	0.276	0.600	.0660	0.619	79.5
88	0.191	1.801	1.047	0.487	0.600	.0924	0.605	79.5
89	0.239	1.801	1.047	0.680	0.600	.112	0.605	79.5
90	0.346	1.801	1.047	1.174	0.600	.149	0.600	79.5
91	0.432	1.801	1.047	1.641	0.600	.175	0.600	79.5
92	0.511	1.801	1.047	2.111	0.600	.197	0.600	79.5
93	0.623	1.801	1.047	2.844	0.600	.224	0.601	79.5
94	0.756	1.801	1.047	3.782	0.600	.251	0.598	79.5
95	0.863	1.801	1.047	4.672	0.600	.271	0.606	79.5
96	0.076	1.176	1.047	0.0845	0.392	.0265	0.640	75.5
97	0.110	1.176	1.047	0.143	0.392	.0372	0.623	75.5
98	0.144	1.176	1.047	0.215	0.392	.0474	0.626	75.5
99	0.176	1.176	1.047	0.287	0.392	.0564	0.616	75.5
100	0.264	1.176	1.047	0.517	0.392	.0788	0.607	75.5
101	0.373	1.176	1.047	0.866	0.392	.103	0.604	75.5
102	0.489	1.176	1.047	1.280	0.392	.125	0.595	75.5
103	0.570	1.176	1.047	1.620	0.392	.138	0.599	75.5
104	0.655	1.176	1.047	1.993	0.392	.151	0.598	75.5
105	0.859	1.176	1.047	2.991	0.392	.177	0.598	75.5
106	0.076	0.589	1.047	0.041	0.196	.013	0.625	76.5
107	0.119	0.589	1.047	0.079	0.196	.020	0.610	76.5
108	0.197	0.589	1.047	0.168	0.196	.031	0.588	76.5
109	0.256	0.589	1.047	0.240	0.196	.038	0.589	76.5
110	0.382	0.589	1.047	0.431	0.196	.052	0.579	76.5
111	0.516	0.589	1.047	0.675	0.196	.065	0.578	76.5
112	0.612	0.589	1.047	0.868	0.196	.072	0.576	76.5
113	0.743	0.589	1.047	1.159	0.196	.081	0.575	76.5
114	0.898	0.589	1.047	1.558	0.196	.091	0.581	76.5
115	0.129	0.119	1.047	0.018	0.040	.004	0.610	80.0
116	0.228	0.119	1.047	0.042	0.040	.007	0.604	80.0
117	0.336	0.119	1.047	0.075	0.040	.010	0.610	80.0
118	0.487	0.119	1.047	0.132	0.040	.013	0.614	80.0
119	0.670	0.119	1.047	0.214	0.040	.016	0.614	80.0
120	0.777	0.119	1.047	0.267	0.040	.017	0.615	80.0

(continued)

Table 2. Discharge Measurements and Computations (continued)

Run No.	h	b	P	Q	$\frac{b}{B}$	$\frac{bh}{B(h+P)}$	C	Temp.
	feet	feet	feet	c.f.s.				°F.
121	0.859	0.119	1.047	0.331	0.040	.018	0.614	80.0
122	0.056	2.704	0.427	0.131	0.901	.105	0.685	77.0
123	0.094	2.704	0.427	0.271	0.901	.162	0.652	77.0
124	0.139	2.704	0.427	0.483	0.901	.222	0.644	77.0
125	0.186	2.704	0.427	0.727	0.901	.273	0.627	77.0
126	0.214	2.704	0.427	0.922	0.901	.301	0.644	77.0
127	0.261	2.704	0.427	1.215	0.901	.341	0.632	77.0
128	0.309	2.704	0.427	1.588	0.901	.378	0.641	77.0
129	0.360	2.704	0.427	2.034	0.901	.412	0.651	77.0
130	0.438	2.704	0.427	2.778	0.901	.456	0.663	77.0
131	0.544	2.704	0.427	3.889	0.901	.505	0.670	77.0
132	0.609	2.704	0.427	4.638	0.901	.530	0.676	77.0
133	0.632	2.704	0.427	5.034	0.901	.538	0.693	77.0
134	0.686	2.704	0.427	5.836	0.901	.555	0.710	77.0
135	0.057	2.399	0.427	0.113	0.800	.094	0.648	77.5
136	0.103	2.399	0.427	0.266	0.800	.155	0.625	77.5
137	0.161	2.399	0.427	0.523	0.800	.219	0.631	77.5
138	0.211	2.399	0.427	0.783	0.800	.265	0.629	77.5
139	0.280	2.399	0.427	1.190	0.800	.317	0.626	77.5
140	0.336	2.399	0.427	1.589	0.800	.352	0.636	77.5
141	0.419	2.399	0.427	2.229	0.800	.396	0.641	77.5
142	0.533	2.399	0.427	3.231	0.800	.444	0.647	77.5
143	0.643	2.399	0.427	4.320	0.800	.481	0.654	77.5
144	0.730	2.399	0.427	5.410	0.800	.505	0.676	77.5
145	0.069	1.801	0.427	0.113	0.600	.083	0.646	77.5
146	0.115	1.801	0.427	0.237	0.600	.127	0.632	77.5
147	0.192	1.801	0.427	0.502	0.600	.186	0.620	77.5
148	0.276	1.801	0.427	0.858	0.600	.236	0.615	77.5
149	0.380	1.801	0.427	1.381	0.600	.283	0.612	77.5
150	0.452	1.801	0.427	1.802	0.600	.308	0.616	77.5
151	0.549	1.801	0.427	2.409	0.600	.337	0.615	77.5
152	0.667	1.801	0.427	3.231	0.600	.366	0.616	77.5
153	0.791	1.801	0.427	4.159	0.600	.389	0.614	77.5
154	0.866	1.801	0.427	4.835	0.600	.402	0.623	77.5
155	0.069	1.176	0.427	0.0752	0.392	.055	0.661	79.0
156	0.095	1.176	0.427	0.118	0.392	.071	0.640	79.0
157	0.170	1.176	0.427	0.273	0.392	.116	0.619	79.0
158	0.237	1.176	0.427	0.442	0.392	.140	0.609	79.0
159	0.357	1.176	0.427	0.811	0.392	.178	0.605	79.0
160	0.491	1.176	0.427	1.299	0.392	.210	0.600	79.0
161	0.601	1.176	0.427	1.764	0.392	.229	0.602	79.0

(continued)

Table 2. Discharge Measurements and Computations (continued)

Run No.	h	b	P	Q	$\frac{b}{B}$	$\frac{bh}{B(h+P)}$	C	Temp.
	feet	feet	feet	c.f.s.				°F.
162	0.738	1.176	0.427	2.407	0.392	.248	0.604	79.0
163	0.898	1.176	0.427	3.218	0.392	.266	0.601	79.0
164	0.052	0.594	0.427	0.024	0.198	.0216	0.638	79.0
165	0.102	0.594	0.427	0.064	0.198	.038	0.614	79.0
166	0.159	0.594	0.427	0.119	0.198	.053	0.591	79.0
167	0.216	0.594	0.427	0.185	0.198	.066	0.581	79.0
168	0.269	0.594	0.427	0.257	0.198	.076	0.579	79.0
169	0.409	0.594	0.427	0.477	0.198	.096	0.574	79.0
170	0.569	0.594	0.427	0.785	0.198	.113	0.576	79.0
171	0.736	0.594	0.427	1.159	0.198	.125	0.578	79.0
172	0.882	0.594	0.427	1.545	0.198	.133	0.587	79.0
173	0.067	0.119	0.427	0.007	0.040	.005	0.647	79.0
174	0.204	0.119	0.427	0.035	0.040	.013	0.606	79.0
175	0.237	0.119	0.427	0.045	0.040	.014	0.609	79.0
176	0.434	0.119	0.427	0.113	0.040	.020	0.621	79.0
177	0.486	0.119	0.427	0.134	0.040	.021	0.621	79.0
178	0.576	0.119	0.427	0.171	0.040	.023	0.618	79.0
179	0.725	0.119	0.427	0.244	0.040	.025	0.625	79.0
180	0.064	2.705	0.148	0.149	0.902	.272	0.637	82.0
181	0.098	2.705	0.148	0.287	0.902	.359	0.646	82.0
182	0.138	2.705	0.148	0.490	0.902	.435	0.661	82.0
183	0.178	2.705	0.148	0.727	0.902	.492	0.669	82.0
184	0.247	2.705	0.148	1.228	0.902	.564	0.691	82.0
185	0.315	2.705	0.148	1.824	0.902	.627	0.713	82.0
186	0.410	2.705	0.148	2.791	0.902	.663	0.735	82.0
187	0.510	2.705	0.148	3.912	0.902	.699	0.761	82.0
188	0.585	2.705	0.148	5.025	0.902	.720	0.777	82.0
189	0.631	2.705	0.148	5.765	0.902	.731	0.796	82.0
190	0.049	2.399	0.148	0.086	0.800	.199	0.619	83.0
191	0.078	2.399	0.148	0.175	0.800	.276	0.626	83.0
192	0.113	2.399	0.148	0.308	0.800	.346	0.631	83.0
193	0.171	2.399	0.148	0.592	0.800	.429	0.652	83.0
194	0.199	2.399	0.148	0.750	0.800	.458	0.659	83.0
195	0.281	2.399	0.148	1.295	0.800	.524	0.677	83.0
196	0.335	2.399	0.148	1.716	0.800	.554	0.690	83.0
197	0.420	2.399	0.148	2.438	0.800	.588	0.698	83.0
198	0.531	2.399	0.148	3.558	0.800	.626	0.717	83.0
199	0.633	2.399	0.148	4.668	0.800	.648	0.723	83.0
200	0.720	2.399	0.148	5.725	0.800	.663	0.730	83.0
201	0.063	1.801	0.148	0.095	0.600	.179	0.627	81.5
202	0.103	1.801	0.148	0.200	0.600	.246	0.628	81.5

(continued)

Table 2. Discharge Measurements and Computations (continued)

Run No.	h	b	P	Q	$\frac{b}{B}$	$\frac{bh}{B(h+P)}$	C	Temp.
	feet	feet	feet	c.f.s.				°F.
203	0.150	1.801	0.148	0.351	0.600	.302	0.628	81.5
204	0.246	1.801	0.148	0.742	0.600	.374	0.632	81.5
205	0.347	1.801	0.148	1.261	0.600	.421	0.641	81.5
206	0.423	1.801	0.148	1.704	0.600	.445	0.643	81.5
207	0.527	1.801	0.148	2.392	0.600	.469	0.649	81.5
208	0.640	1.801	0.148	3.197	0.600	.487	0.649	81.5
209	0.775	1.801	0.148	4.250	0.600	.504	0.647	81.5
210	0.862	1.801	0.148	4.963	0.600	.512	0.644	81.5
211	0.068	1.176	0.148	0.0722	0.392	.123	0.649	81.0
212	0.113	1.176	0.148	0.149	0.392	.170	0.624	81.0
213	0.160	1.176	0.148	0.251	0.392	.203	0.623	81.0
214	0.227	1.176	0.148	0.420	0.392	.237	0.618	81.0
215	0.362	1.176	0.148	0.852	0.392	.278	0.622	81.0
216	0.467	1.176	0.148	1.250	0.392	.298	0.623	81.0
217	0.570	1.176	0.148	1.695	0.392	.311	0.626	81.0
218	0.668	1.176	0.148	2.150	0.392	.321	0.626	81.0
219	0.791	1.176	0.148	2.724	0.392	.330	0.616	81.0
220	0.900	1.176	0.148	3.308	0.392	.337	0.616	81.0
221	0.068	0.591	0.148	0.035	0.197	.062	0.622	81.0
222	0.133	0.591	0.148	0.093	0.197	.093	0.609	81.0
223	0.182	0.591	0.148	0.145	0.197	.109	0.592	81.0
224	0.225	0.591	0.148	0.198	0.197	.119	0.588	81.0
225	0.319	0.591	0.148	0.332	0.197	.135	0.584	81.0
226	0.416	0.591	0.148	0.498	0.197	.145	0.587	81.0
227	0.504	0.591	0.148	0.664	0.197	.152	0.588	81.0
228	0.623	0.591	0.148	0.918	0.197	.159	0.591	81.0
229	0.746	0.591	0.148	1.209	0.197	.164	0.594	81.0
230	0.893	0.591	0.148	1.591	0.197	.169	0.596	81.0
231	0.066	0.119	0.148	0.007	0.040	.012	0.633	82.5
232	0.152	0.119	0.148	0.023	0.040	.020	0.617	82.5
233	0.232	0.119	0.148	0.043	0.040	.024	0.614	82.5
234	0.328	0.119	0.148	0.074	0.040	.028	0.621	82.5
235	0.373	0.119	0.148	0.090	0.040	.028	0.622	82.5
236	0.445	0.119	0.148	0.117	0.040	.030	0.622	82.5
237	0.487	0.119	0.148	0.135	0.040	.030	0.625	82.5
238	0.557	0.119	0.148	0.168	0.040	.031	0.637	82.5
239	0.589	0.119	0.148	0.178	0.040	.032	0.622	82.5
240	0.780	0.119	0.148	0.276	0.040	.033	0.632	82.5
241	0.231	2.706	0.000	1.454	0.901	0.901	0.898	77.0
242	0.301	2.706	0.000	2.270	0.901	0.901	0.942	77.0
243	0.369	2.706	0.000	3.066	0.901	0.901	0.934	77.0

(continued)

Table 2. Discharge Measurements and Computations (continued)

Run No.	h feet	b feet	P feet	Q c.f.s.	$\frac{b}{B}$	$\frac{bh}{B(h+P)}$	C	Temp. °F.
244	0.445	2.706	0.000	4.095	0.901	0.901	0.945	77.0
245	0.519	2.706	0.000	5.120	0.901	0.901	0.938	77.0
246	0.212	2.399	0.000	1.019	0.800	0.800	0.813	75.0
247	0.303	2.399	0.000	1.831	0.800	0.800	0.854	75.0
248	0.377	2.399	0.000	2.589	0.800	0.800	0.873	75.0
249	0.452	2.399	0.000	3.527	0.800	0.800	0.904	75.0
250	0.550	2.399	0.000	4.199	0.800	0.800	0.802	75.0
251	0.620	2.399	0.000	6.086	0.800	0.800	0.972	75.0
252	0.204	1.800	0.000	0.637	0.600	0.600	0.719	75.0
253	0.250	1.800	0.000	0.879	0.600	0.600	0.731	75.0
254	0.324	1.800	0.000	1.381	0.600	0.600	0.779	75.0
255	0.349	1.800	0.000	1.474	0.600	0.600	0.743	75.0
256	0.414	1.800	0.000	1.936	0.600	0.600	0.756	75.0
257	0.520	1.800	0.000	2.749	0.600	0.600	0.761	75.0
258	0.608	1.800	0.000	3.480	0.600	0.600	0.763	75.0
259	0.697	1.800	0.000	4.209	0.600	0.600	0.751	75.0
260	0.202	1.176	0.000	0.380	0.392	0.392	0.664	75.0
261	0.328	1.176	0.000	0.796	0.392	0.392	0.672	75.0
262	0.423	1.176	0.000	1.175	0.392	0.392	0.678	75.0
263	0.495	1.176	0.000	1.476	0.392	0.392	0.673	75.0
264	0.576	1.176	0.000	1.868	0.392	0.392	0.679	75.0
265	0.658	1.176	0.000	2.262	0.392	0.392	0.673	75.0
266	0.782	1.176	0.000	2.912	0.392	0.392	0.669	75.0
267	0.259	0.592	0.000	0.276	0.197	0.197	0.661	75.0
268	0.341	0.592	0.000	0.411	0.197	0.197	0.653	75.0
269	0.437	0.592	0.000	0.583	0.197	0.197	0.638	75.0
270	0.519	0.592	0.000	0.759	0.197	0.197	0.642	75.0
271	0.588	0.592	0.000	0.912	0.197	0.197	0.640	75.0
272	0.680	0.592	0.000	1.126	0.197	0.197	0.635	75.0
273	0.765	0.592	0.000	1.337	0.197	0.197	0.632	75.0
274	0.209	0.119	0.000	0.041	0.040	0.040	0.669	74.0
275	0.303	0.119	0.000	0.069	0.040	0.040	0.654	74.0
276	0.375	0.119	0.000	0.095	0.040	0.040	0.652	74.0
277	0.449	0.119	0.000	0.125	0.040	0.040	0.654	74.0
278	0.589	0.119	0.000	0.186	0.040	0.040	0.648	74.0
279	0.671	0.119	0.000	0.224	0.040	0.040	0.640	74.0
280	0.756	0.119	0.000	0.268	0.040	0.040	0.643	74.0

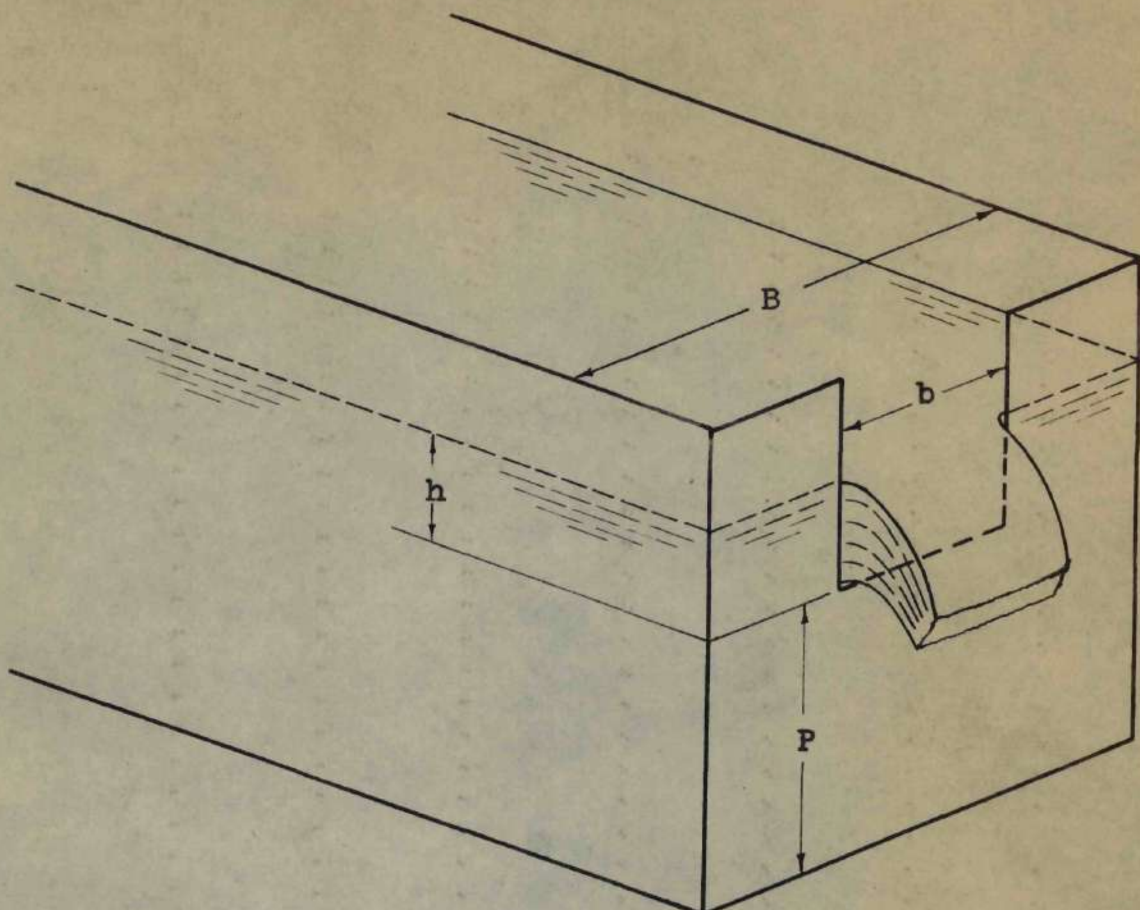

Figure 1. Rectangular Notch Weir in a Rectangular Channel.

Figure 2. Glass-Walled Steel Flume Used for Weir Experiments.

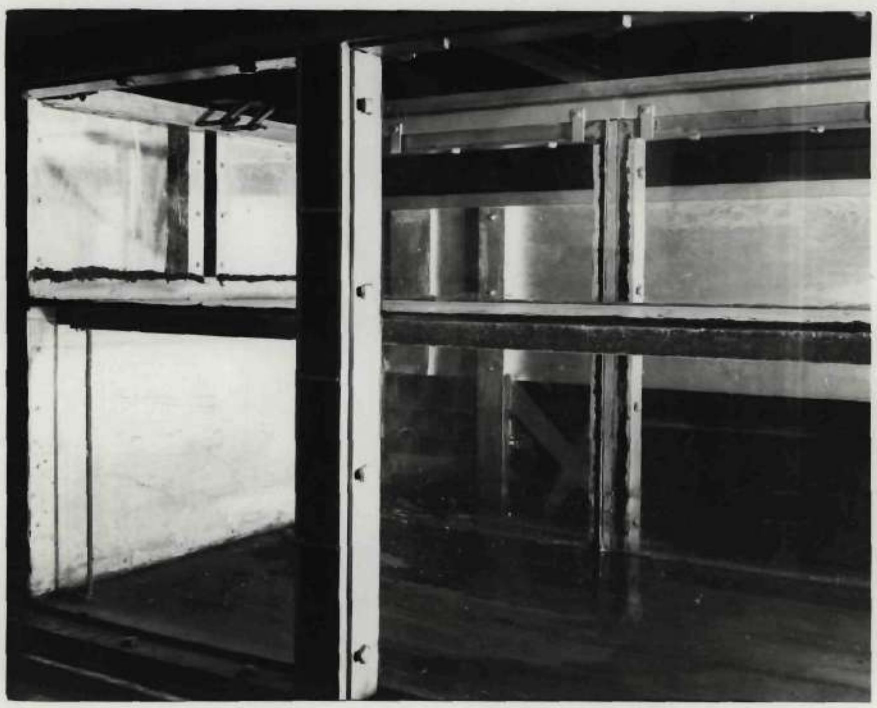

Figure 3. False Floor in Position Upstream from Weir.

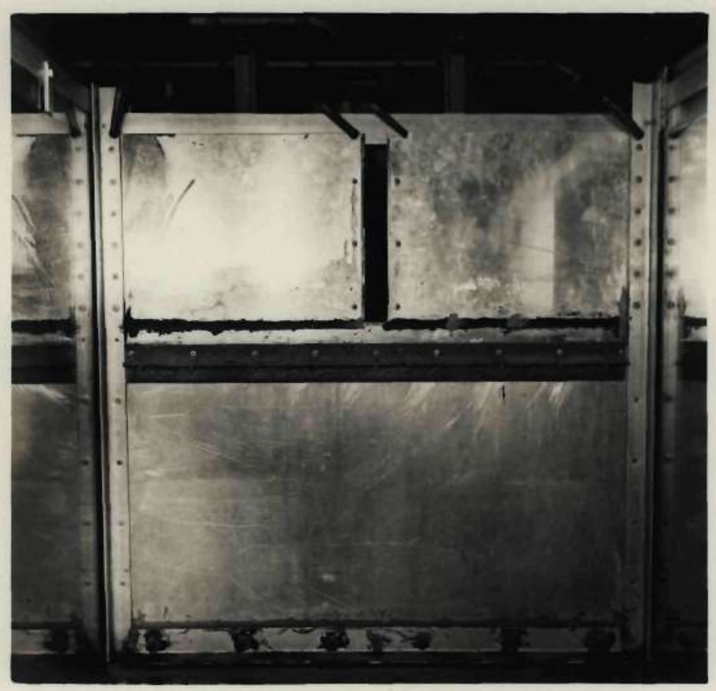

Figure 4. Weir Plate, b/B = 0.04.

Figure 5. Weighing Tank for Discharge Measurement.

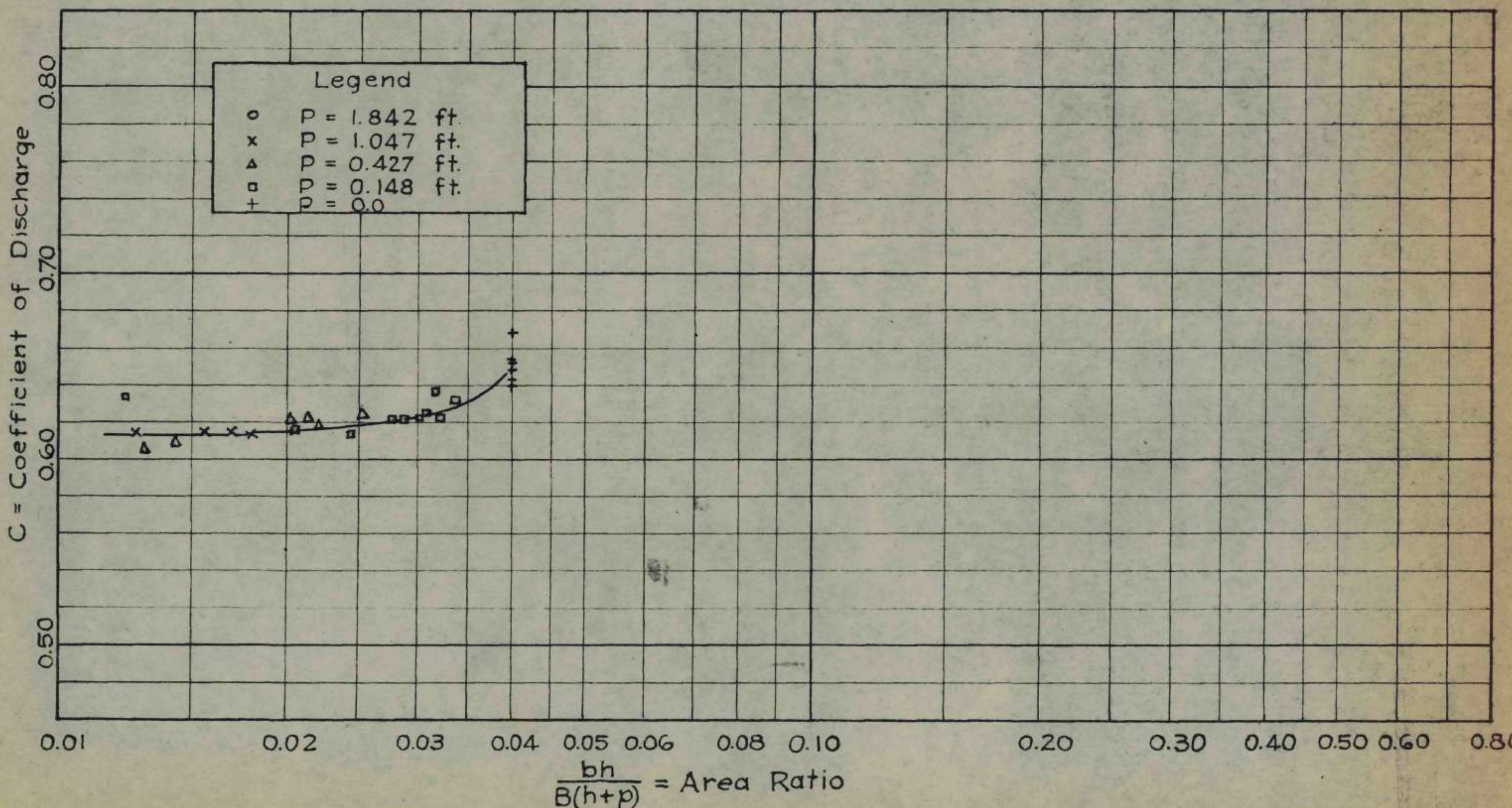

Figure 6. Coefficient of Discharge (Experimental); b/B = 0.04.

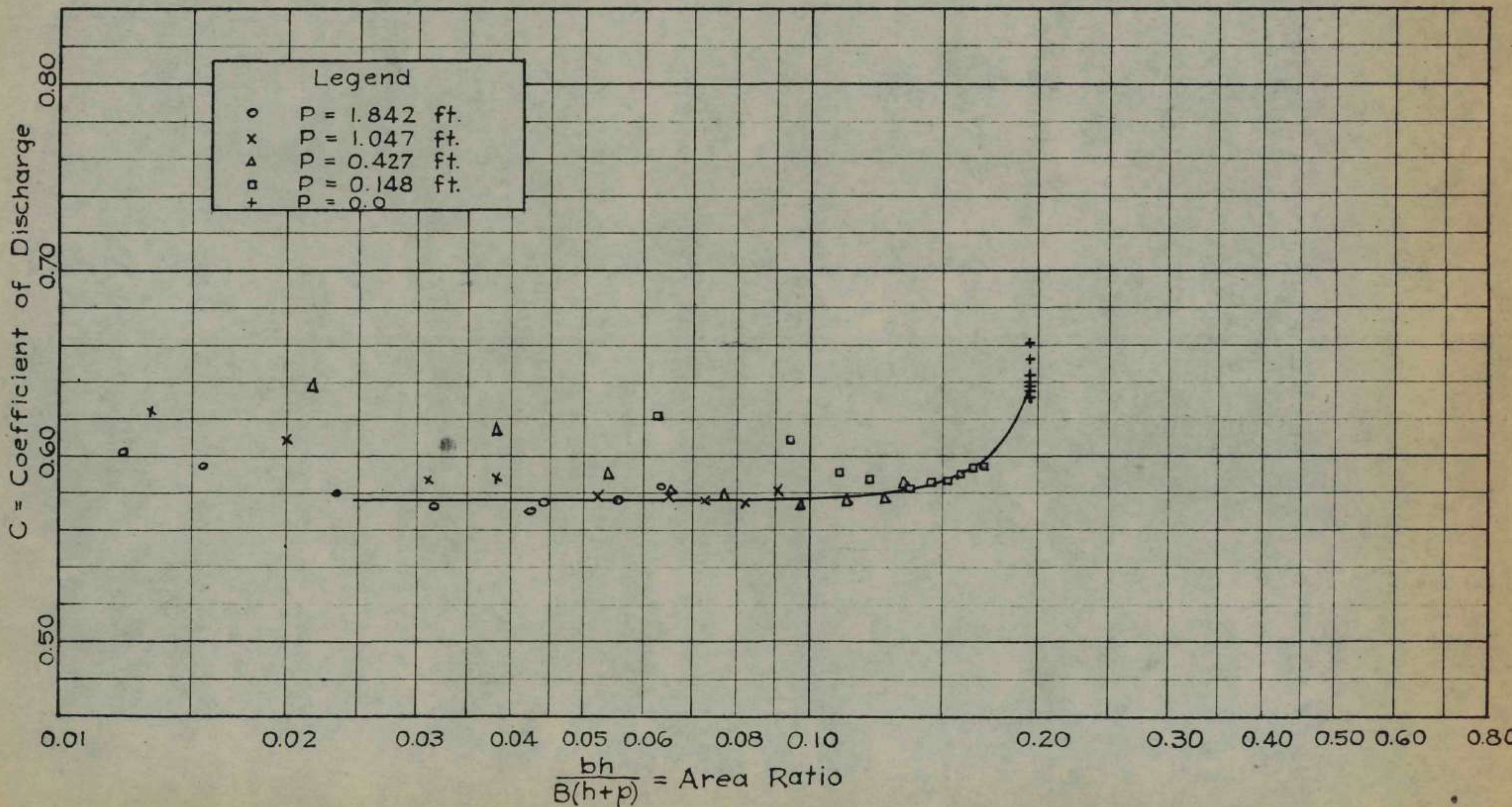

Figure 7. Coefficient of Discharge (Experimental); b/B = 0.197.

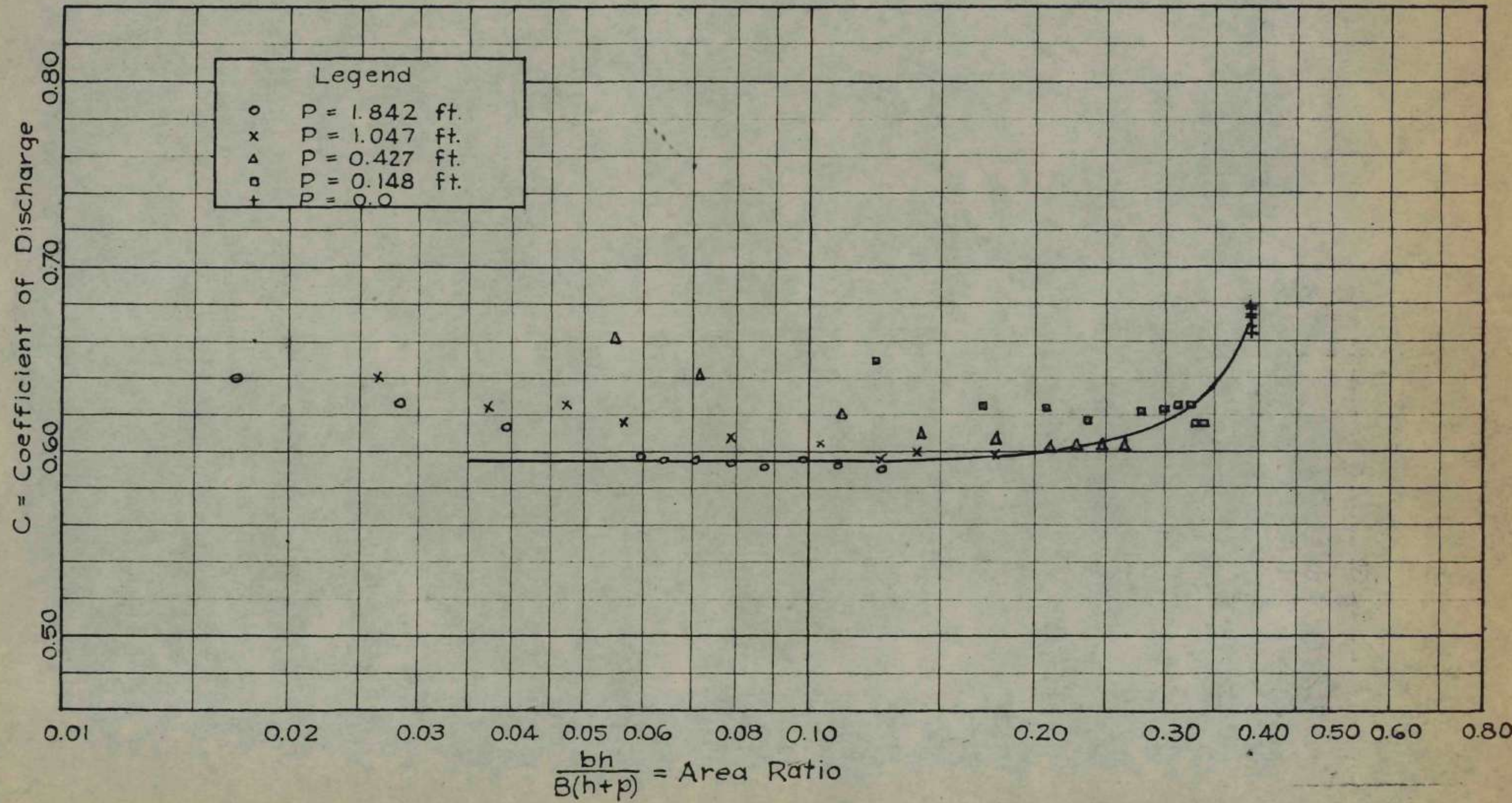

Figure 8. Coefficient of Discharge (Experimental); b/B = 0.392.

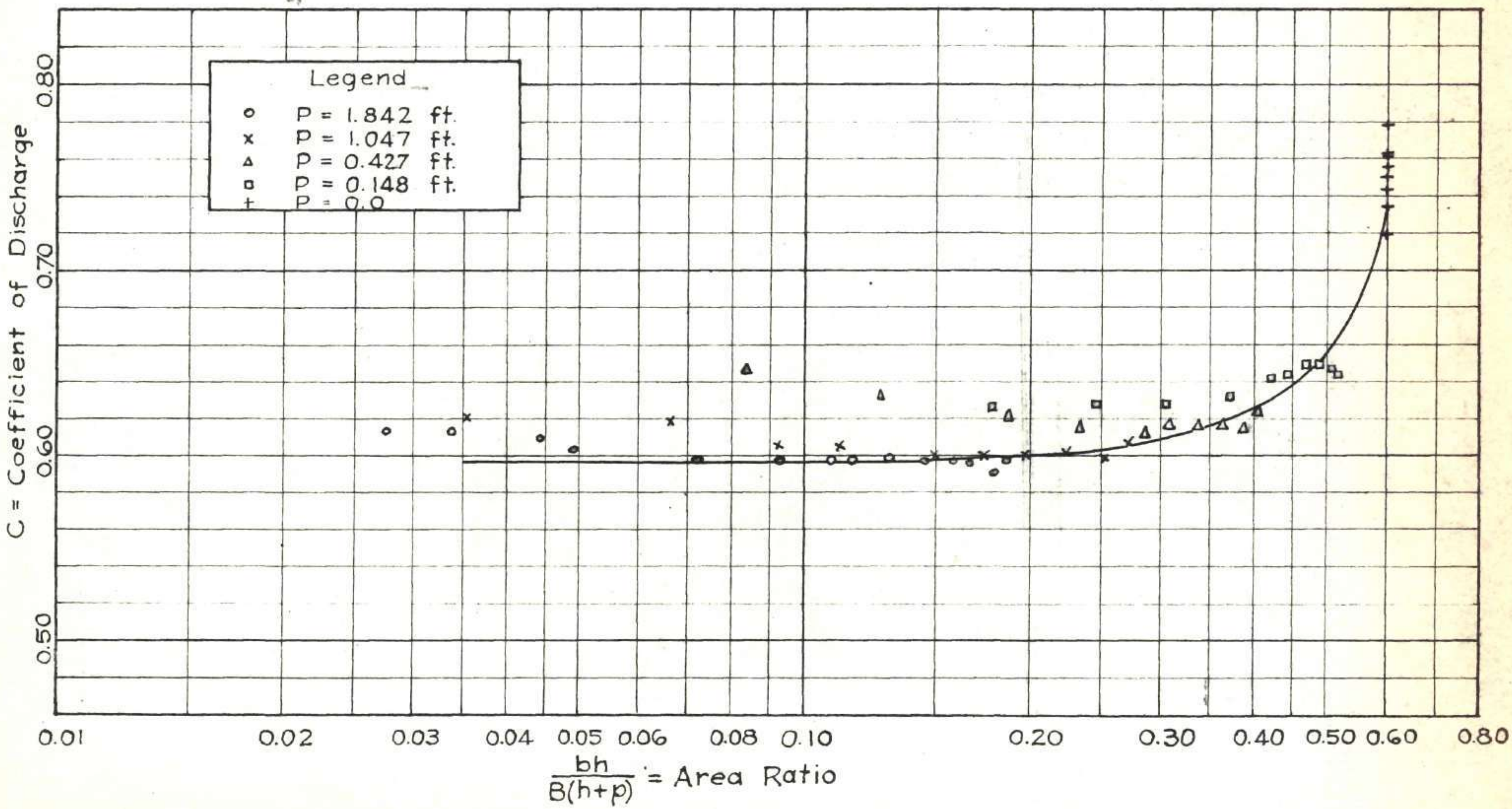

Figure 9. Coefficient of Discharge (Experimental); b/B = 0.60.

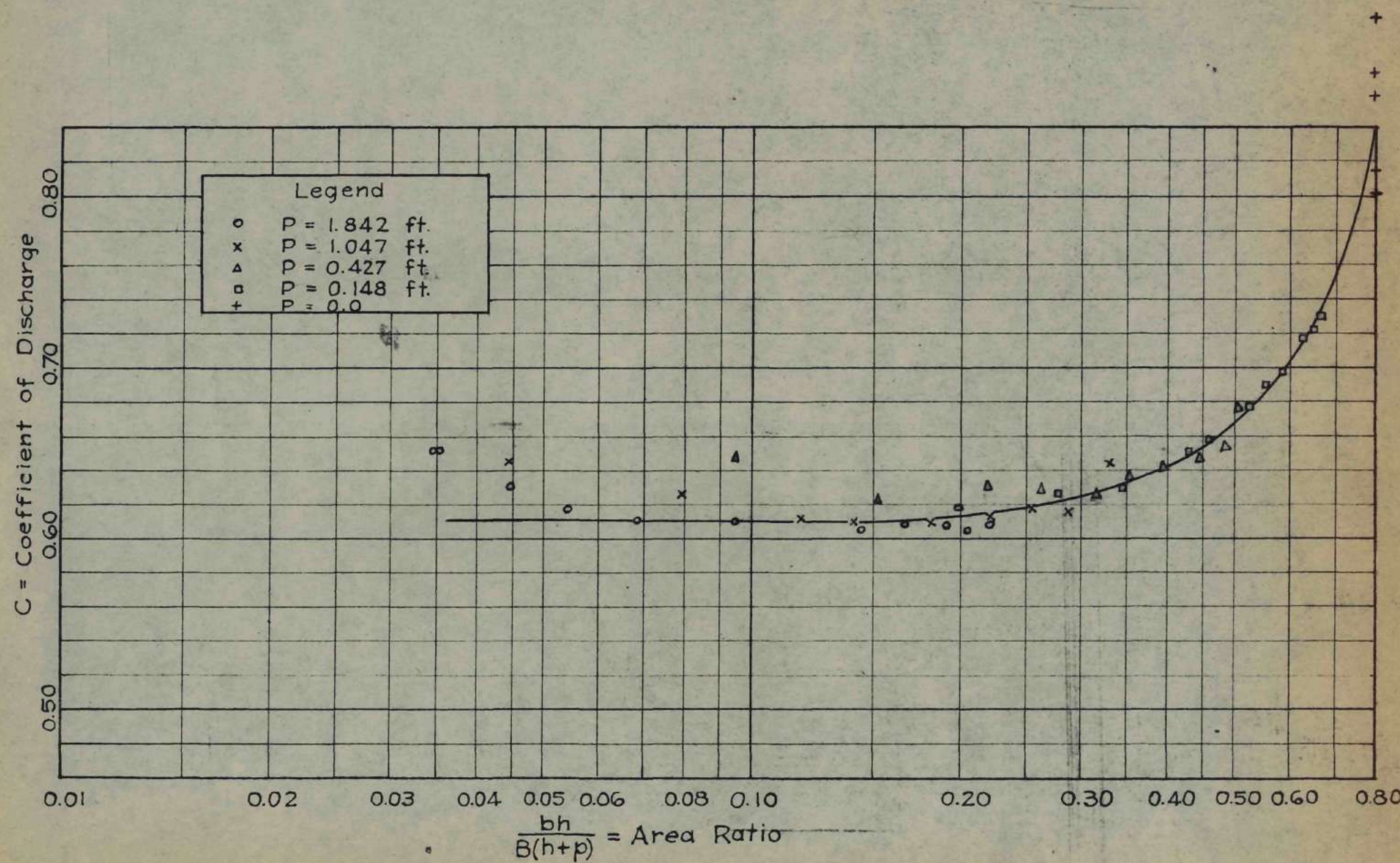

Figure 10. Coefficient of Discharge (Experimental); b/B = 0.80.

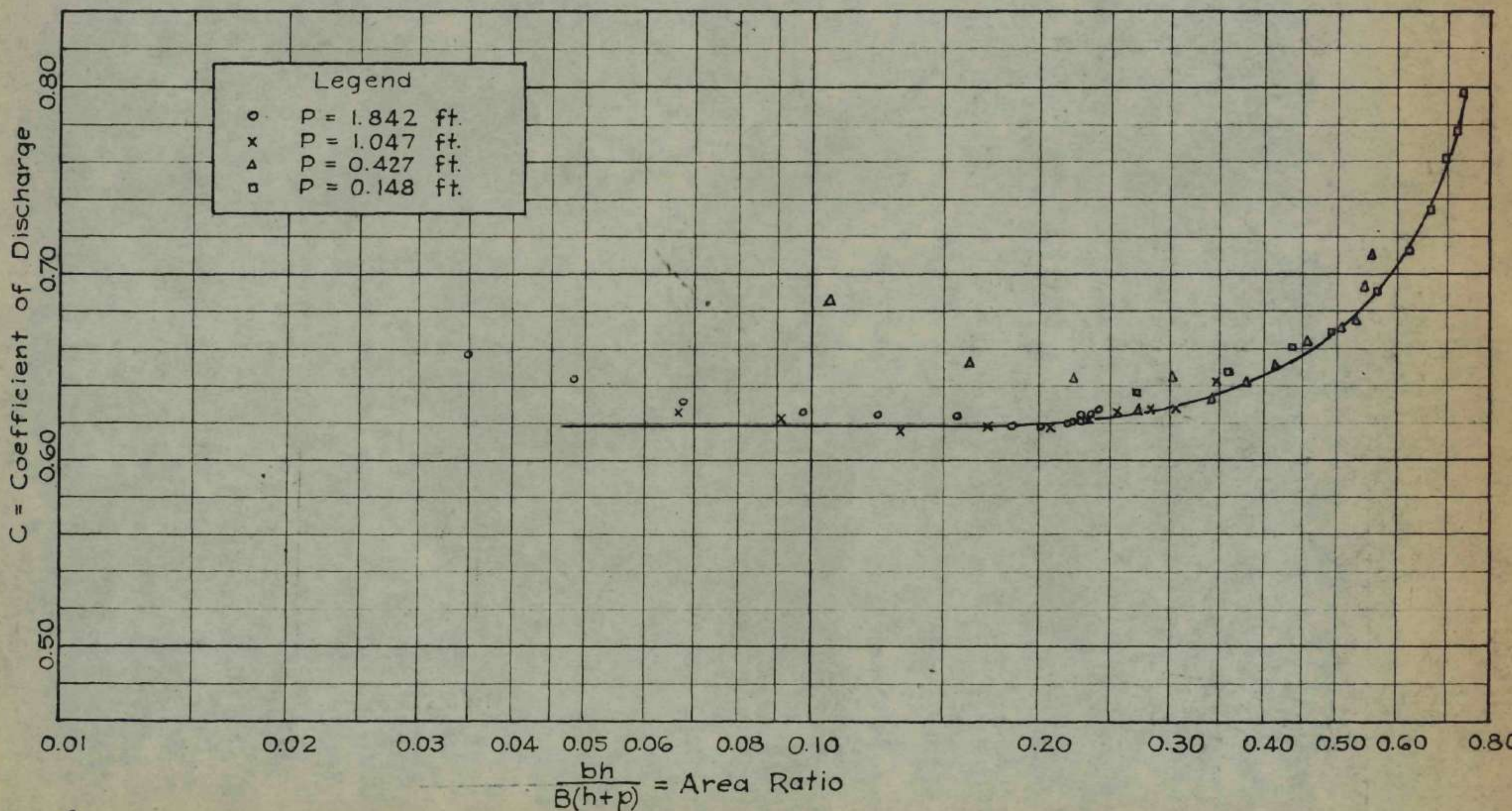

Figure 11. Coefficient of Discharge (Experimental); b/B = 0.902.

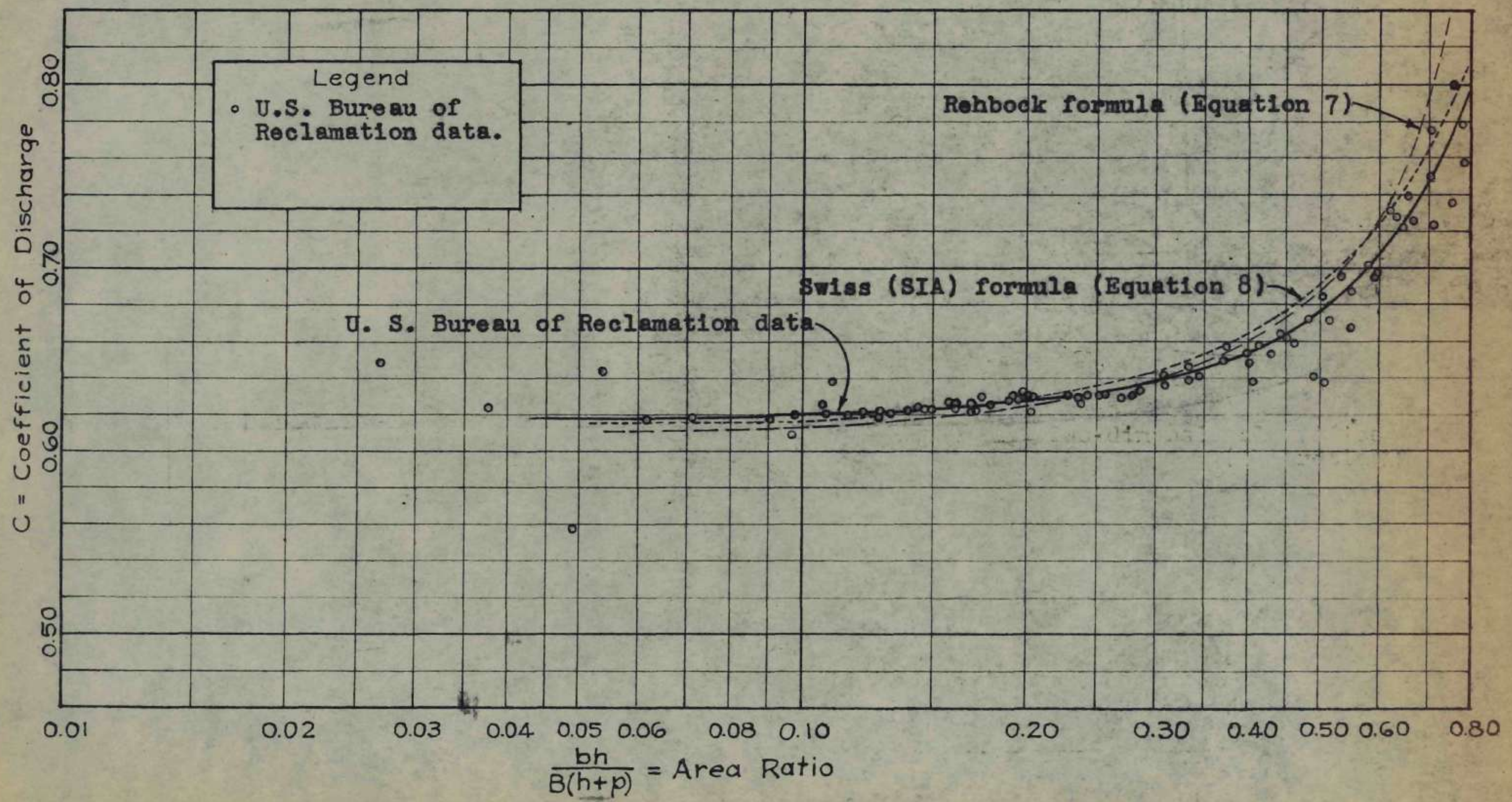

Figure 12. Coefficient of Discharge, Suppressed Weir; b/B = 1.0.

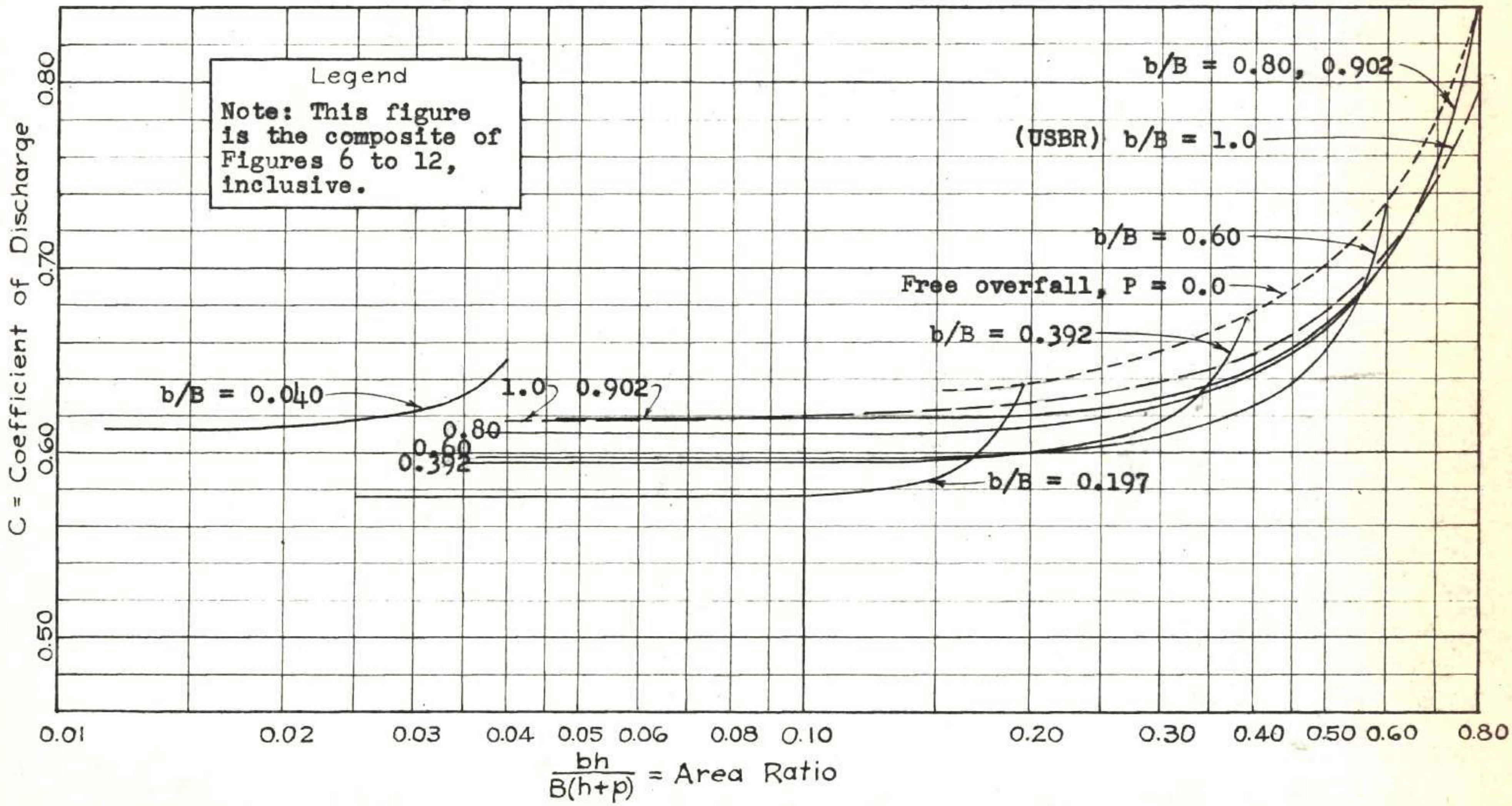

Figure 13. Discharge Characteristics of the Rectangular Notch Weir.

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